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INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE SALMON FISHERIES IN
THE FRASER RIVER SYSTEM

ANNUAL REPORT
1948

COMMISSIONERS:

EDWARD W. ALLEN
ALBERT M. DAY
A. J. WHITMORE
A. L. HAGER (January)
MILO MOORE
TOM REID
OLOF HANSON (April to December)

NEW WESTMINSTER,
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FIG. 1.—The sockeye spawning grounds at the outlet of Chilko Lake. This picture was taken during the low water period in April, 1949.

REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1948

The International Pacific Salmon Fisheries Commission, created in 1937 under the provisions of the Convention ratified by the governments of Canada and the United States on July 28, 1937, is charged with the protection, preservation and extension of the sockeye salmon fishery of the Fraser River system. Among these defined duties, modified by the Protocol of Exchange of Ratifications, lies the responsibility for:

1. Investigating the natural history of the Fraser River sockeye salmon, hatchery methods, spawning ground conditions and other related matters.

2. The improvement of spawning grounds, the construction and maintenance of hatcheries, rearing ponds, and other such facilities as may be determined to be necessary for the propagation of sockeye salmon.

3. The study of obstructions to the ascent of sockeye salmon that may now exist or that may occur, and recommendations for their removal or modification where the studies show that such removal or other action is desirable.

4. The adoption of regulations which limit or prohibit the taking of sockeye in Treaty defined waters in order to obtain proper escapement for the maintenance of the fishery and to obtain as nearly as may be practical an equal sharing of the catch by each High Contracting Party.

The Convention and the Protocol of Exchange further provided that the Commission should not promulgate or enforce regulations until scientific investigations provided for in the Convention had been made covering two normal cycles of sockeye salmon runs, or eight years.

The eight years of scientific investigation were concluded in 1945. During this period a thorough study was made of the serious decline in the runs of sockeye salmon to the Fraser River, a decline which resulted in economic loss to the fishermen of Canada and the United States since 1913 of over $279,000,000 on one cycle alone based on United States Government prices for 1942. Had the decline in theoretical cases produced been based on 1948 values the staggering sum of over $500,000,000 would have to be assigned to the factors causing the depletion of the Fraser sockeye. Scientific evidence has been obtained during the Commission's investigation which showed that an obstruction to the migration at Hell's Gate was the major cause of the depletion in the runs. Other factors were the Adams River dam built in 1908 and the Quesnel dam constructed in

1898. Contributing natural causes were obstructions at Bridge River Rapids on the Fraser River and Farwell Canyon on the lower Chilcotin River.

Correction of the obstructions at Hell's Gate, Bridge River Rapids, and Farwell Canyon was recommended. Appropriations were secured permitting fishways of unique and effective design to be constructed. The dam on Adams River was removed in 1945. The Quesnel dam had been removed in 1921, before the advent of the Commission. Thus in 1948 the Fraser River became relatively free of major obstructions. Today the Fraser River is probably in more favorable condition for the successful survival of sockeye salmon than at any other time in the history of the fishery.

The possibility of overfishing has not been overlooked but has been seriously considered. Prior to when the Commission was empowered to regulate, a biological staff was organized and a program of investigation outlined. Most of the Fraser River watershed was explored. Existing populations of spawning stocks were located and sound methods of measuring their annual numbers were evolved. A statistical system was developed to furnish daily records of sockeye landings by areas and units of gear from both the Canadian and United States fisheries. With the establishment of a measure of catch and escapement, a requirement for sound regulation was provided.

Salt water and river tagging experiments were carried out to determine the difference, if any, in the time and speed of migration of the races or populations of sockeye salmon and whether these factors varied from year to year, also the relationship of fishing intensity to the escapement and its variation, if any, between races. That each race possesses a high degree of individuality was well established from this work. Each race was found to migrate through the fishery at a particular time, on its own schedule, arriving on the spawning grounds of its parents with a high degree of consistency. Precise measures of availability as to time and of the effect of fishing intensity remain to be determined. Nevertheless the persistent individuality of each race as shown by this work must be considered for sound regulation. The catch-escapement ratio of each race and the timing of the catch and escapement are basic control factors for the maintenance of each year's run of that race. The required catch-escapement ratio may vary with the numerical size, reproductive efficiency and other limitations of the individual races.

Selective depletion has occurred as a result of the variable effects of Hell's Gate and other obstructions in the Fraser Basin. During the exploration of the watershed certain races, once of dominant size, were found to be extinct or almost so. Three out of four cycles to the Quesnel River area are practically non-existent, and of the fourth cycle only a remnant of 1,050 fish was found in 1941 as compared with the 4,000,000 fish recorded by Provincial authorities in 1909. Upper Adams River in the Shuswap Lake area, once a major producer of "early run" fish, has no spawning run whatsoever. The Driftwood River at the head of Takla Lake is in a like condition at least three years out of four. The Middle and Tachie Rivers in the Stuart system when first explored revealed few if any fish. The Fraser-Francois Lake system, once a major producer, had annual runs

of 1,500 to 5,700 adult sockeye during the period extending from 1938 through 1941. This selective depletion of once dominant races forms the basis of another requirement for sound regulation. The high degree of individuality of each race of sockeye spawning in the Fraser River requires, where remnants of a race remain, that special consideration by regulation be given to allow self-rehabilitation.

The Commission's power of regulation became operative in 1946. By this time the major obstacles to the migration of sockeye to their spawning grounds had been eliminated. Based on the requirements as outlined, the Commission's primary objectives for the first four years of regulation (1946-1949) were to: 1. Provide rigid protection as far as practicable to those races which have suffered the most severe depletion. 2. Increase the escapement to all areas, thus allowing for an early return to maximum production of all races. 3. Allow for the maintenance of the industry during the first cycle of rigid regulation by nearly normal fishing on the most abundant races, and 4. Provide as near as practical the equal sharing in the catch by the nationals of the two countries concerned.

That great progress has been made towards the first two objectives is evident in Table I. The third has been substantially accomplished by the Commission's regulations which have tended to protect the early light runs while allowing heavier fishing on the known large runs. The fourth objective has been difficult to achieve because of the rapidity with which the catch can become unbalanced. On some runs even a single day's catch by the fishermen of one country can permanently unbalance the catch for that year. The machinery of promulgation for almost immediate closure does not permit an exact equal division of catch. Furthermore, precise pre-season estimates of anticipated catches must be developed by further statistical treatment and biological studies of the relationship of racial survival to spawning escapements. In spite of these difficulties the total United States catch for the first three years of regulation has been 4,729,000 fish as compared with 5,346,000 fish taken by Canadian fishermen, a difference of only six per cent. The total United States catch for the four years prior to regulation by the Commission was 4,317,000 fish: the Canadian catch for the same period was 7,370,000 fish, or a differential of twenty-six per cent.

Where a race has been exterminated, rehabilitation cannot be accomplished by regulation. A new race must be artificially established if that area is again to become productive. To meet this latter need for rehabilitation, an experimental field station has been established on the Quesnel watershed to determine feasible methods for transferring races of sockeye to barren areas. The runs, successfully transferred, are expected to maintain themselves by natural propagation in the adopted area. Previous experiments in transplanting Fraser River sockeye apparently have failed to establish self-maintaining runs but in studying the circumstances relevant to these failures the Commission has gained information which indicates a probability of success in the new program.

The Commission met four times during the year 1948. Its first meeting was held in Vancouver, B. C., on January 12, 13 and 14.

TABLE I

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1940, 1944, 1948.

District and Streams	*Periods of Spawning* Arrival	End	*Estimated No. Sockeye* 1940	*Present* 1944	1948	1948 *Sex Ratio (%)* Males 3-yr.	Males 4-5-yr.	Females 3-yr.	Females 4-5-yr.
LOWER FRASER									
Cultus Lake	Sept. 25	Dec. 14	74,121	14,200	13,086	2.4	42.8	0.2	54.6
Upper Pitt River (incl. tributaries)	Aug. 6	Sept. 20	Present	Present	53,000		37.7		62.3
Widgeon Slough	Oct.	Dec. 7	——*	1,050	——*				
HARRISON									
Big Silver Creek	Sept. 1	Oct. 7	5,149	5,192	12,000		52.2		47.8
Douglas Creek	Sept. 5	Oct. 7	337	36	350		43.6		56.4
East Creek	Oct.	Nov. 2	28	65	45				
Harrison River	Nov. 15	Dec. 15	11,000	73	26,000	0.1	44.2		55.7
Hatchery Creek	Oct. 5	Nov. 11	400	63	150		37.5		62.5
Weaver Creek	Oct. 3	Nov. 7	17,600	16,441	20,000	2.7	22.7		74.6
LILLOOET									
Birkenhead River	Sept. 1	Oct. 31	27,320	57,707	120,000	31.6	20.0		48.4
Upper Lillooet streams			5,800	11,404	——				
SOUTH THOMPSON									
Seymour River	Aug. 20	Sept. 15	600	200	4,000	4.0	44.6		51.4
Adams Lake and Tribs.			——	——	——				
Adams River	Sept. 28	Nov. 25	9,900	1,367	12,600	13.5	16.5	3.4	66.6
Little River, Little Shuswap Lake	Oct. 3	Nov. 25	1,700	200	2,400	62.2	21.5	8.6	7.7
Shuswap Lake and Tribs.	Sept. 1	Sept. 17	——	0	50				
South Thompson River	Oct. 3	Nov. 25	100	——	100				
NORTH THOMPSON									
Raft River	Aug. 12	Sept. 23	11,400	1,082	10,500		40.6		59.4
CHILCOTIN									
Chilko River	Aug. 21	Nov. 1	545,000	328,655	670,000	0.1	39.8		60.1
Chilko Lake			Present	Present	Present				
Taseko River	Sept.		——	——	Present				
QUESNEL									
Horsefly River	Aug.	Sept.	90	3	50				
Little Horsefly River	Sept.	Oct.	——	2	0				
Mitchell River			——	——	0				
NECHAKO									
Endako River			8	1	0				
Francois Lake			2	——	0				
Nadina River	Aug.	Sept.	——	——	30				
Nithi River	Aug.	Sept.	0	0	1				
Ormonde Creek	Aug.	Sept. 22	36	15	150				
Stellako River	Sept. 7	Nov. 10	2,600	3,294	16,000	3.6	38.0		58.4
Uncha Creek			——	——	0				
STUART LAKE									
Driftwood River			——	——	——				
Forfar Creek	July 27	Sept. 1	90	46	1,500	4.4	30.5		65.1
Gluske Creek	July 28	Sept. 1	0	——	1,500	9.7	28.9		61.4
Kazchek Creek	Sept. 5	Oct. 5	10	3	80	100.0			
Kynoch Creek	July 26	Sept. 1	195	350	7,500	3.0	31.0		66.0
Middle River	Sept. 10	Oct. 10	300	22	200	100.0			
Narrows Creek			5	0	0				
Rossette Creek	July 27	Sept. 1	0	2	1,500	11.1	28.4		60.5
Shale Creek			——	——	——				
Tachie River	Sept. 20	Oct. 31	——	——	20	100.0			
NORTHEAST									
Upper Bowron River	July 26	Sept. 13	4,625	1,700	25,218		46.5		53.5

*Fish may have been present but no observation was made.

On January 12 and 13 the meeting was devoted to a review of the biological investigations of the staff during the 1947 season. On January 14 the Commission met with the Advisory Committee to discuss the proposed fishing regulations for the 1948 season.

The following members of the Advisory Committee met with the Commission.

Group Represented	*Canada*	*United States*
Packers	R. Nelson	C. J. Collins
Gill Net Fishermen	H. Stevens	C. Karlson
Purse Seine Fishermen	G. Miller	N. Mladinich
Sports Fishermen	M. W. Black	—— ——
Troll Fishermen	A. E. Carr	—— ——

The second meeting of the year was held on March 30 at the offices of the State of Washington Director of Fisheries, L. C. Smith Building, Seattle, Washington. At this meeting regulations for the 1948 season were adopted.

A resolution was passed in tribute to the memory of A. L. Hager who died January 16, 1948, and of sympathy to members of his family. Mr. Hager will long be remembered for his untiring efforts to further the work of the Commission. On April 8, 1948, Mr. Olof Hanson was appointed to succeed Mr. Hager as a Commissioner.

A meeting was held at the Parliament Buildings, Ottawa, Ontario, on June 21 and 22. Fiscal arrangements were discussed by the Commission with governmental officials of Canada and the United States. Alvin Anderson of Bellingham, Washington, was appointed to the Advisory Board to represent the United States Trollers.

The final meeting of the year was held at Bellingham, Washington, on November 29 and 30. The Commission reviewed the 1948 season's regulations and the biological and engineering projects carried on during the year. L. A. Royal was appointed Chief Biologist effective January 1, 1949, to replace R. Van Cleve who resigned to become Acting Director of the School of Fisheries at the University of Washington.

On November 30, tentative regulations for 1949 were discussed with the Advisory Board.

The following members of the Advisory Board were present at this meeting.

Group Represented	*Canada*	*United States*
Packers	R. Nelson	C. J. Collins J. N. Plancich*
Gill Net Fishermen	P. Jenewein*	P. Scott
Purse Seine Fishermen	G. A. Brajcich*	N. Mladinich S. A. Johnson*
Sports Fishermen	M. W. Black	Ken McLeod
Troll Fishermen	A. E. Carr	A. Anderson

*Alternate representative.

1948 REGULATIONS

The recommendations for regulations to govern the sockeye fisheries in Treaty waters during the 1948 season were adopted by the Commission on March 30, 1948, in compliance with Articles IV and V of the Treaty. These provisions as approved were transmitted to the Departments of Fisheries of the Dominion of Canada and of the State of Washington. They were accepted as regulations for Canadian Treaty waters by an Order in Council adopted on June 22, 1948, and for United States Treaty waters by order of the Director of the Washington State Department of Fisheries promulgated April 8, 1948.

The recommendations of the Commission were as follows:

CANADIAN WATERS

The International Pacific Salmon Fisheries Commission appointed pursuant to The Convention relating to the protection, preservation and extension of the Sockeye Salmon Fisheries between the United States of America and Canada signed at Washington on the twenty-sixth day of May, 1930, hereby recommends to the Honorable the Minister of Fisheries that regulations to the following effect, in the interests of such Fisheries, be adopted by Order in Council as amendments to the Special Fishery Regulations under authority of the Fisheries Act, namely:

1. No one shall fish for or take any kind of salmon by any gill-net having a mesh of less than eight inches (8") extension measure when wet during the period in the Spring or Chinook salmon fishing season commencing at Midnight, June 30, 1948, and extending up to 6.00 a.m. on July 28, 1948, in the waters of District No. 1 and those waters of the southern portion of District No. 3 bounded on the west by that part of a straight line projected from Bonilla Point on Vancouver Island to Tatoosh Lighthouse, Washington, that lies between said Bonilla Point and the point of intersection of such straight line with the International Boundary line; and on the north by a straight line drawn from Welcome Point on Sechelt Peninsula, thence in a straight line to Point Young on Lasqueti Island, thence in a straight line to Dorcas Point on Vancouver Island.

2. No one shall fish for or take sockeye salmon in 1948 before 6.00 p.m., July 18, 1948, in those waters of District No. 3 embraced in Areas 19, 20 and that part of Area 21 lying easterly of a straight line drawn between Bonilla Point on Vancouver Island and Tatoosh Lighthouse, Washington.

3. No one shall fish for or take sockeye salmon by means of gill-nets, in 1948, before 6.00 a.m. on July 28, 1948, in the waters of District No. 1 and those waters of the southern portion of District No. 3 described in paragraph one (1) hereof but not including the waters of Areas 19, 20 and that part of Area 21 lying easterly of a straight line drawn between Bonilla Point on Vancouver Island and Tatoosh Lighthouse, Washington.

4. Fishing for or taking sockeye salmon by means of purse-seines shall not be permissible in 1948 before 6.00 a.m. on July 28, 1948, in such waters of Areas 17 and 18 as fishing for or taking sockeye salmon by purse-seines may be allowed.

5. No one shall buy, sell, or have in his possession any sockeye salmon taken in the waters of District No. 1 and those waters of the southern portion of District No. 3 as described in Paragraph one (1)hereof, during the time fishing for such salmon is prohibited therein.

6. The Chief Supervisor of Fisheries for British Columbia, consistent with authority vested in him, may implement recommendations which may be made from time to time by the International Pacific Salmon Fisheries Commission respecting additional close times for fishing for sockeye salmon in the waters of District No. 1 and those waters of the southern portion of District No. 3 described in paragraph one (1) hereof; provided that a Public Notice by the Chief Supervisor of any such additional close time is posted once on the cannery or canneries adjacent to the area or areas in which such extension is to be made effective, at least twenty-four hours in advance of such extension.

7. Nothing contained herein shall apply to the taking of sockeye salmon in waters of District No. 1 and those waters of the southern portion of District No. 3 as described in paragraph one (1) hereof by the International Pacific Salmon Fisheries Commission, or its duly authorized representatives, for the purpose of exercising its objects under the Fraser Sockeye Convention.

Two modifications were made in the original recommendations of the Commission as provided for in recommendation No. 6. These were: 1. The addition of 24 hours to the customary 48 hour weekly closed season in those waters of the southern portion of Fisheries District No. 3, bounded on the west by that part of a straight line projected from Bonilla Point on Vancouver Island to Tatoosh Lighthouse, State of Washington, that lies between said Bonilla Point and the point of intersection of such straight line with the International Boundary; and on the north by the northerly boundary of Area No. 19, i.e., a straight line drawn from the northerly entrance to Shoal Harbour on Vancouver Island to the most northerly point of Domville Island; thence due east magnetic to its junction with the International Boundary line, and 2. The addition of 24 hours to the customary 48 hour weekly closed season in District No. 1 effective August 2, 1948.

UNITED STATES WATERS

The International Pacific Salmon Fisheries Commission appointed pursuant to The Convention relating to the protection, preservation and extension of the Sockeye Salmon Fisheries between the United States of America and Canada signed at Washington on the twenty-sixth day of May, 1930, hereby recommends to the Director of Fisheries of the State of Washington that regulations to the following effect in the interests of such fisheries be adopted by him by virtue of authority in him vested by Section 5 of Chapter 3 of the laws of the State of Washington of 1933, namely:

1. That in the waters of the United States of America embraced in Paragraph No. 2 of Article I of The Convention relating to the protection, preservation and extension of the sockeye salmon fisheries between the United States of America and Canada signed at Washington the 26th day of May, 1930, no one shall fish for or take sockeye salmon commercially prior to 1.00 a.m. on the 18th day of July, 1948, and after 6.00 p.m. on the 13th day of August, 1948, until 6.00 a.m., September 1, 1948.

2. That in the waters of the United States of America embraced in Paragraph No. 2 of Article I of the said Convention there shall be not less than a 36-hour weekly closure for each type of gear used in the taking of or fishing for sockeye salmon during the period that the fishing for sockeye salmon is not prohibited.

3. That in the waters of the United States of America embraced in Paragraph No. 2 of Article I of the said Convention, in order to secure a proper escapement of sockeye salmon, no one shall fish for or take any kind of salmon by any gill-net having a mesh of less than 8" extension measure when wet during the period in the spring or chinook salmon fishing season commencing on the first day of June, 1948, and extending up to 1.00 a.m. on the 18th day of July, 1948, and commencing at 6.00 p.m. on August 13, 1948, and extending up to 6:00 a.m. on September 1, 1948. After 6:00 a.m. on September 1, 1948, no one shall fish for or take any kind of salmon by any gill-net having a mesh of less than 6½" extension measure. During the specified closed periods it shall be unlawful to fish for, possess, sell or purchase sockeye salmon.

4. Nothing contained in any rules or regulations relating to fishing for or taking sockeye salmon shall apply to the taking of sockeye salmon within the waters of the United States of America embraced in Paragraph No. 2 of Article I of said Convention by the International Pacific Salmon Fisheries Commission or its servants or agents acting pursuant to its directions for the purpose of exercising its objects under the said Convention.

The only modification in the recommended fishing regulations in 1948 for the United States Treaty waters was the closing of the season at 6.00 p.m. on August 11 instead of 6.00 p.m. on August 13 to permit the Canadian catch to approach parity.

THE UNITED STATES FISHERY

Nineteen canneries in the United States received the sockeye caught in the United States Convention waters. The total landings and the pack in full cases for the United States and Canada are shown in Table II.

TABLE II

LANDINGS AND PACK 1940, 1944, 1948

	United States	*Canada*	*Total*
1940			
Total Landings* (No. sockeye)	657,000	1,033,000	1,690,000
Total Pack (48 lb. cases)	59,354	93,361	152,715
1944			
Total Landings (No. sockeye)	436,000	1,004,000	1,440,000
Total Pack (48 lb. cases)	37,379	88,150	125,529
1948			
Total Landings (No. sockeye)	1,089,000	752,000	1,841,000
Total Pack (48 lb. cases)	90,441	61,650	152,091

*Total landings for 1940 as published in the Annual Report for 1944, International Pacific Salmon Fisheries Commission, have been revised.

The daily landings as listed in Table IV show that the run came as anticipated. Few fish appeared before the last week in July and the peak occurred as usual between the 31st day of July and the 3rd day of August. In 1940 the sockeye were taken in fairly large numbers as early as July 18 but this was not

the case in either 1936, 1944, or 1948. Normally the Chilko run, which predominates in numbers on this cycle, and also on the following one, passes through the fishery very rapidly. After reaching a sharp peak it declines in abundance so that by August 6 it is no longer available in large numbers to United States fishermen. In 1936, 1937, 1941, 1944 and 1945 this was the case. A second peak in the catch, the larger of the two, was recorded on August 6 in 1940. Since this was the exception, a recurrence of a similar situation was not expected for 1948. The appearance of a second peak in the catch on August 8 and 9 during 1948 combined with greatly increased fishing intensity, created such a disparity between the catch of the two countries that the Commission deemed it advisable to close the season in United States waters two days earlier than anticipated in order to comply with Article VII of the Treaty. In spite of the early closure the United States catch at the end of the season comprised 59.16 per cent of the total Fraser River production.

TABLE III

LICENSED GEAR OPERATING IN
UNITED STATES CONVENTION WATERS

	Purse Seines	*Gill Nets*	*Reef Nets*
1940	140	82	69
1944	60	55	40
1948	195	151	87

THE CANADIAN FISHERY

Individual landing statistics were obtained from the various canneries and buyers through their co-operation with the Commission. Data for studies of availability, fishing intensity and other factors relating to sound management were obtained from the fishermen through log books and personal interviews. Particular attention was given to the fishery operating between July 1 and July 28 when nets having a mesh less than 8 inches extension measure were prohibited to prevent the taking of sockeye.

TABLE IV

DAILY LANDINGS OF SOCKEYE, 1940-1944-1948 FROM UNITED STATES TREATY WATERS SHOWING NUMBER OF SOCKEYE TAKEN DAILY AND CUMULATIVE PER CENT OF SEASON TOTAL AS OF EACH DATE

Date	JULY						AUGUST					
	1940		1944		1948		1940		1944		1948	
	Daily Sockeye	Cum. % Total	Daily Sockeye	Cum. % Total	Daily Sockeye	Cum. % Total	Daily Sockeye	Cum. % Total	Daily Sockeye	Cum. % Total	Daily Sockeye	Cum. % Total
1	617	.30	76				48,141	53.99	58,865	66.63	118,062	36.98
2	8	.30					47,306	61.19	46,797	77.37	100,423	46.20
3	42	.31	37	.03					28,555	83.92	97,469	55.15
4	5	.31	6	.03			29,215	65.64	20,120	88.54	67,360	61.33
5	341	.36	5	.03			36,389	71.18	1,817	88.96	60,700	66.91
6			24	.03			57,375	79.92	7,557	90.69	68,962	73.24
7			65	.05			31,172	84.67	6,913	92.28		
8	131	.38	46	.06			29,494	89.16	9,228	94.40	115,926	83.88
9	36	.39	133	.09			22,432	92.57	3,860	95.28	101,997	93.25
10	52	.40	169	.13			60	92.59	3,149	96.01	38,878	96.82
11	77	.41	98	.15			8,231	93.84	5,786	97.34	17,288	98.41
12	251	.45	105	.17			3,221	94.33	125	97.36		
13			164	.21			4,652	95.04	1,765	97.77		
14	2,006	.75	242	.27			4,766	95.76	2,262	98.29		
15	7,181	1.85	12	.27			7,972	96.98	366	98.37		
16	3,752	2.42	1,382	.59			3,330	97.48	1,235	98.66		
17	8,016	3.64	1,290	.88			380	97.54	935	98.87		
18	14,083	5.78	2,661	1.50	1,900	.17	1,717	97.80	425	98.97		
19	15,756	8.18	3,641	2.33	2,469	.40	3,057	98.27				
20	5	8.18	8,989	4.39	6,348	.98	1,236	98.46	1,395	99.29		
21	28,836	12.57	8,187	6.27	8,622	1.78	333	98.51	1,618	99.66		
22	22,302	15.97	1,808	6.69	5,671	2.30	89	98.52	224	99.71		
23	13,152	17.97	9,972	8.98	5,142	2.77	71	98.53	79	99.73		
24	24,060	21.64	14,489	12.30			24	98.53	11	99.73		
25	22,406	25.05	11,484	14.94	17,524	4.38	617	98.63	75	99.75		
26	5,829	25.94	17,769	19.02	22,251	6.42	26	98.63				
27	18,425	28.74	25,757	24.93	23,441	8.57	179	98.66	51	99.76		
28	19,645	31.73	18,885	29.26	42,887	12.51	283	98.70	150	99.79		
29	19,769	34.74	1,163	29.53	69,529	18.90	866	98.83	243	99.85		
30	34,775	40.04	45,312	39.93	78,843	26.14	466	98.91	192	99.89		
31	43,488	46.66	57,459	53.12					17	99.90		
Total	305,046		231,430		284,627		343,100		203,815		787,065	
June	1,388	.21										
September							6,284	.96	447	.10	14,537	1.33
October							894	.13			2,831	.26
Season Total							656,712	100.00	435,692	100.00	1,089,060	100.00

Table V

DAILY LANDINGS OF SOCKEYE, 1940-1944-1948 FROM CANADIAN TREATY WATERS SHOWING NUMBER OF SOCKEYE TAKEN DAILY AND CUMULATIVE PER CENT OF SEASON TOTAL AS OF EACH DATE

	JULY						AUGUST					
	1940		1944		1948		1940		1944		1948	
Date	*Daily Sockeye*	*Cum. % Total*	*Daily Sockeye*	*Cum. % Total*	*Daily Sockeye*	*Cum. % Total*	*Daily Sockeye*	*Cum. % Total*	*Daily Sockeye*	*Cum. % Total*	*Daily Sockeye*	*Cum. % Total*
1	258	.10	73	.05			27,313	36.46	120,977	34.74		
2	27	.11					23,588	38.74	93,421	44.05	13,246	8.97
3	41	.11	92	.06			1,523	38.89	93,186	53.33	58,405	16.74
4	381	.15	206	.08					90,654	62.36	55,578	24.14
5	161	.16	156	.09			47,557	43.50	54,048	67.74	61,232	32.28
6	326	.19	445	.14			81,503	51.39			57,044	39.87
7			171	.16			43,828	55.63	36,570	71.39	5,850	40.65
8	956	.29	564	.21			41,506	59.65	54,881	76.85		
9	2,254	.50	40	.22			44,189	63.92	31,471	79.99	47,075	46.91
10	2,360	.73	490	.26			167	63.94	32,209	83.20	88,175	58.64
11	3,122	1.04	1,704	.43					22,011	85.39	54,451	65.88
12	4,048	1.43	1,154	.55			4,120	64.34	21,018	87.48	41,829	71.44
13	5,626	1.97	1,911	.74			18,464	66.13			32,863	75.81
14			1,436	.88			10,828	67.17	5,509	88.03	982	75.94
15	6,101	2.56	1,748	1.06			9,577	68.10	10,170	89.05	3	75.94
16	9,783	3.51					5,749	68.66	4,972	89.54	11,188	77.43
17	9,971	4.47	2,557	1.31			8,799	69.51	8,246	90.36	23,947	80.62
18	15,289	5.95	4,168	1.73					8,421	91.20	22,614	83.63
19	14,580	7.37	5,254	2.25			5,914	70.08	9,560	92.15	12,376	85.27
20	13,985	8.72	7,448	2.99			18,686	71.89			10,614	86.68
21			4,921	3.48			6,026	72.48	4,637	92.62		
22	20,561	10.71	12,328	4.71	3,845	.51	8,314	73.28	12,051	93.82		
23	23,854	13.02			637	.60	7,025	73.96	4,785	94.29	3,669	87.17
24	26,642	15.60	16,213	6.32			5,726	74.51	3,121	94.60	13,616	88.98
25	34,371	18.93	26,734	8.99					3,028	94.91	7,239	89.94
26	29,529	21.78	25,569	11.53	20	.60	1,302	74.64			9,624	91.23
27	796	21.86	20,554	13.58	75	.61	5,098	75.13	39	94.91	5,725	91.99
28			12,855	14.86	6,334	1.45	2,564	75.38	3,311	95.24		
29	34,495	25.20	7,681	15.63	13,555	3.25	1,841	75.56	7,046	95.94		
30	60,726	31.08			15,764	5.35	501	75.61	750	96.02	519	92.06
31	28,281	33.82	70,865	22.69	13,991	7.21	1,113	75.72	1,280	96.15	2,246	92.36
Total	348,524		227,337		54,221		432,821		737,372		640,110	
May and June	807	.08	398	.04								
September							37,783	3.66	27,480	2.74	34,192	4.54
October							47,063	4.55	11,131	1.11	23,289	3.10
Unassigned as to date of landing							166,002	16.07				
Season total							1,033,000	100.00	1,003,718	100.00	751,812	100.00

Fishing for sockeye commenced in Canadian waters at Sooke and in the waters west of Sooke on July 18 and in the Fraser River on July 28. While the run arrived in United States waters as anticipated, no large numbers of fish were available to Canadian fishermen for fully a week after they had normally appeared on this cycle (Table V). Purse seining in Canadian Treaty waters was not permitted in Area 17 and was not attempted in Area 18. All operations by this type of gear were carried out in Areas 19 to 23. Very few sockeye were taken by purse seines for the total season's catch by this gear was only 14,500 fish. A total of 18 boats operated in the above listed area. The number of gill-net boats fishing for sockeye in the Fraser River has been calculated to be 1400 for 1940, 1800 for 1944, and 1350 for 1948.

INDIAN CATCH

The recording of sockeye catches by Indians in the various districts of the Fraser River watershed has been continued. These records are compiled incidentally to the recovery of the tagged fish.

The number of tags recovered and the tag ratio of the sockeye seen on the drying racks are used to compute the numbers of salmon caught.

The records of the catches for the various districts are shown in Table VI for both 1944 and 1948. The total catch of 1948 was approximately twice that of the previous cycle. The increases in the catch are due primarily to the increases of the runs to the spawning grounds, thus allowing an increased catch with little change in fishing effort on the part of the Indians.

Table VI

THE INDIAN CATCHES OF SOCKEYE SALMON BY DISTRICTS AND THE AREAS WITHIN THESE DISTRICTS, 1944 - 1948

District and Areas	1944 *Catch*	1944 *Per Cent of Total Catch*	1944 *No. of Fishermen*	1948 *Catch*	1948 *Per Cent of Total Catch*	1948 *No. of Fishermen*
HARRISON-BIRKENHEAD						
Skookumchuk	295		4			
Lillooet Lake						
Birkenhead River	4,557		60	3,781		—
TOTAL	4,852	11.3	64	3,781	4.4	—
LOWER FRASER						
Seabird Island						
Katz and Ruby Creeks	909		12	1,009		3
TOTAL	909	2.1	12	1,009	1.2	3
CANYON						
Union and American Bar	773		4	—		—
Yale	2,555		12	4,632		13
Spuzzum	284		3	251		2
Lower Gorge	483		2	356		2
Upper Gorge	1,610		3	591		3
Boston Bar	22		1	—		—
Boothroyd	1,986		13	2,442		6
Cisco	4,165		24	4,417		15
TOTAL	11,878	27.7	62	12,583	14.6	41
LYTTON TO LILLOOET	3,506	8.2	18	18,157	21.0	18
BRIDGE RIVER RAPIDS						
Lillooet	746		11	10,028		24
Rapids	6,082		60	16,357		28
Pavilion	749		23	1,518		4
TOTAL	7,577	17.7	94	27,903	32.3	56
CHILCOTIN						
Farwell	2,851		14	1,862		9
Hanceville	2,087		12	4,248		10
Alexis Creek	5,265		39	4,979		30
Keighley Holes	2,411		9	6,499		16
Henry's Crossing	615		4	—		—
TOTAL	13,229	30.9	78	17,588	20.4	65
UPPER FRASER						
Alkali Lake				50		25
Chimney Creek				500		31
Soda Creek				550		19
Alexandria				175		9
Quesnel				350		6
Shelley	185		—	480		7
TOTAL	185	0.4	—	2,031	2.4	99
NECHAKO						
Nautley Reserve	272		7	480		7
Stella Reserve	345		7	625		8
TOTAL	617	1.5	14	1,105	1.3	15
STUART LAKE						
Fort St. James				600		14
Tachie Reserve				400		10
Trembleur and Takla Lakes				50		2
TOTAL	32	0.1	—	1,050	1.2	26
THOMPSON						
Thompson				300		—
North Thompson River	10		1	250		—
South Thompson River	25		1	500		—
TOTAL	35	0.1	2	1,050	1.2	—
GRAND TOTAL	42,820			86,257		

ESCAPEMENT

The escapement of sockeye to the various streams of the Fraser River system as estimated from tagging enumeration, indices, and actual counts is shown in Table I. As in 1947 the success of the regulations was again apparent in the 1948 escapement of the early runs to the upper river areas. A separate comparison of some of these spawning runs in 1948 with those of 1944 is made in Table VII.

TABLE VII

COMPARISON OF UPRIVER ESCAPEMENTS OF 1944 AND 1948

	1944	*1948*	*Percentage Increase*
Raft River	1,100	10,500	855%
Chilko River & Lake	329,000	670,000	104%
Quesnel	5	50+	900%
Nechako	3,300	16,000	385%
Stuart Lake District (early)	400	12,000	2900%
Bowron	1,700	25,000	1370%

The largest increase in the escapement to the upper river areas occurred in the Stuart Lake district with a gain of 2900 per cent over the number recorded in the brood year. The Bowron escapement was next with a gain of 1370 per cent. The Chilko run which came through the commercial fishery during the height of fishing had an escapement to the spawning grounds of over twice that of the brood year.

Some of the lower river runs below Hell's Gate are large enough as individual units to add considerably to the commercial catch. The Birkenhead race has been consistently numerous in the past four years and this year was no exception with 82,000 adults on the spawning redds. The Upper Pitt River escapement totalled 53,000 fish in 1948. The Pitt River sockeye are noted for their large size. No delays or mortalities resulted from the previous obstructions at Hell's Gate, Bridge River Rapids and Farwell Canyon where fishways are now operative. The sockeye migrating to the northern district were observed in all instances to be in excellent condition as they arrived on the spawning areas.

THE 1949 CYCLE

The daily sockeye landings for 1937, 1941 and 1945 in United States Treaty waters are presented in Table VIII for the convenience of the industry in following the comparative trend of the 1949 run as it arrives. Likewise Table IX lists the daily totals for sockeye taken in Canadian Treaty waters for the years 1941 and 1945. Daily totals are not available for 1937 in the Canadian area.

From the data presented for 1941 and 1945 it is indicated that a sizeable number of "early" sockeye will escape to spawning grounds before the season opens July 19 in Puget Sound and July 25 in the Fraser River. If this occurs, at least some of these depleted populations will substantially increase in number.

Table VIII

DAILY LANDINGS OF SOCKEYE, 1937-1941-1945 FROM UNITED STATES TREATY WATERS SHOWING NUMBER OF SOCKEYE TAKEN DAILY AND CUMULATIVE PER CENT OF SEASON TOTAL AS OF EACH DATE

	JULY						AUGUST					
	1937		1941		1945		1937		1941		1945	
Date	*Daily Sockeye*	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*
1	2		1,087	.07	2		30,046	15.05	111,086	60.48	45,394	73.22
2	31		723	.12	57	.01	41,983	19.72			28,114	77.15
3	238	.03	247	.14	287	.05	49,050	25.19	94,303	66.53	12,583	78.90
4	46	.04	87	.14	213	.08	44,524	30.15	133,392	75.08	805	79.02
5	122	.05	36	.15	946	.21	37,410	34.31	109,495	82.09	20,721	81.91
6	604	.12	525	.18	793	.32	34,252	38.13	55,735	85.66	13,772	83.83
7	265	.15	1,260	.26	49	.33	809	38.22	27,338	87.42	10,841	85.34
8	322	.18	1,999	.39	2,405	.66	28,347	41.37	21,700	88.81	11,969	87.01
9	449	.23	1,757	.50	4,449	1.28	30,891	44.81			7,446	88.05
10			1,402	.59	3,926	1.83	24,891	47.58	21,295	90.17	6,277	88.93
11	600	.30	1,759	.70	2,259	2.15	19,349	49.74	15,266	91.15	83	88.94
12	379	.34	311	.72	1,359	2.34	24,902	52.51	12,995	91.98	5,437	89.70
13	157	.36	4,820	1.03	641	2.43	16,838	54.39	12,727	92.80	4,769	90.36
14	228	.38	8,513	1.58	495	2.49	1,366	54.54	6,936	93.24	2,612	90.73
15	876	.48	8,284	2.11	3,300	2.96	35,603	58.50	11,878	94.00	3,580	91.23
16	756	.57	8,881	2.68	4,561	3.59	47,269	63.77			3,867	91.77
17	552	.63	9,807	3.31	7,899	4.69	35,127	67.68	11,685	94.75	3,446	92.25
18	1,459	.79	9,573	3.92	13,521	6.58	51,876	73.46	10,266	95.41	18	92.25
19	2,486	1.07	375	3.94	10,599	8.06	37,046	77.58	9,557	96.02	9,693	93.60
20	1,998	1.29	14,545	4.87	2,487	8.41	21,049	79.93	10,305	96.68	9,354	94.91
21	3,845	1.72	25,053	6.48	52	8.41	2,496	80.20	5,849	97.06	8,081	96.03
22	5,372	2.31	35,856	8.78	40,668	14.09	19,028	82.32	5,295	97.40	6,997	97.01
23	4,958	2.87	47,973	11.85	58,445	22.24	21,191	84.68			3,417	97.49
24	2,353	3.13	60,168	15.71	29,628	26.38	24,666	87.43	6,861	97.84	2,263	97.80
25	5,018	3.69	35,052	17.96	62,805	35.14	12,488	88.82	5,302	98.18	89	97.81
26	26,597	6.64	767	18.00	32,460	39.67	19,756	91.02	4,889	98.49	2,006	98.09
27	10,858	7.85	84,809	23.44	29,380	43.77	10,883	92.23	3,663	98.73	1,826	98.35
28	5,018	8.41	87,698	29.06	3,522	44.26	141	92.25	3,329	98.94	1,760	98.60
29	11,697	9.71	87,028	34.64	28,938	48.30	9,955	93.36	3,511	99.16	1,153	98.76
30	13,166	11.18	141,289	43.69	64,273	57.27	4,432	93.85			766	98.86
31	4,738	11.70	151,002	53.37	68,978	66.89	11,660	95.15	971	99.22	2,179	99.17
Total	105,100		832,686		479,397		749,324		715,629		231,318	
May and June			84		461	.06						
September							43,500	4.84	11,566	.75	5,509	.77
October							70	.01	517	.03		
Season total							897,994	100.00	1,560,482	100.00	716,685	100.00

TABLE IX

DAILY LANDINGS OF SOCKEYE, 1941-1945* FROM CANADIAN TREATY WATERS SHOWING NUMBER OF SOCKEYE TAKEN DAILY AND CUMULATIVE PER CENT OF SEASON TOTAL AS OF EACH DATE

Date	JULY				AUGUST			
	1941		1945		1941		1945	
	Daily Sockeye	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*	*Daily Sockeye*	*Cum.% Total*
1	192	.10	4	.11	109,312	41.66	68,497	57.85
2	1,030	.15	1,023	.21	135,307	48.05	59,389	63.97
3	1,319	.21	6,433	.88			50,579	69.19
4	1,384	.28	3,362	1.22	74,434	51.57	34,507	72.75
5	2,854	.41	8,882	2.14	136,935	58.04		
6			11,962	3.37	140,533	64.68	20,155	74.83
7	1,784	.50	7,735	4.17	119,828	70.34	39,375	78.89
8	4,780	.72			90,875	74.63	13,784	80.31
9	5,529	.98	7,336	4.93	84,705	78.63	19,773	82.35
10	7,257	1.33	9,686	5.93			10,865	83.47
11	8,141	1.71	7,855	6.74	47,214	80.86	8,743	84.37
12	8,915	2.13	9,036	7.67	57,490	83.58		
13			7,449	8.44	39,868	85.46	6,838	85.08
14	3,158	2.28	7,809	9.24	36,728	87.20	8,987	86.01
15	15,447	3.01			22,083	88.24	4,158	86.43
16	12,214	3.59	5,757	9.84	29,907	89.65	7,016	87.16
17	15,974	4.34	16,554	11.54			3,857	87.56
18	7,718	4.71	11,877	12.77	13,987	90.31		
19	9,873	5.17	19,733	14.81	26,474	91.57		
20			15,893	16.44	10,124	92.04	5,000	88.07
21	16,601	5.96	10,602	17.54	13,202	92.67	11,945	89.30
22	33,604	7.55			16,657	93.45	7,906	90.12
23	18,197	8.40	17,291	19.32	15,239	94.17	7,134	90.38
24	25,787	9.62	28,811	22.29			5,088	91.38
25	35,526	11.30	31,668	25.56	7,379	94.52		
26	36,815	13.04	42,472	29.94	11,852	95.08		
27			45,728	34.66	6,207	95.38	2,963	91.69
28	73,864	16.53	31,352	37.89	4,527	95.59	9,074	92.62
29	156,285	23.91			2,391	95.70	2,619	92.89
30	122,522	29.70	41,206	42.14	3,068	95.85	4,026	93.31
31	143,786	36.49	83,731	50.78	580	95.88	2,391	93.55
Total	770,556		491,247		1,256,906		414,669	
May & June	1,935	.09	1,038	.11				
September					79,925	3.77	56,455	5.83
October					7,382	.35	6,035	.62
Season					2,116,704	100.00	969,444	100.00

*Total 1937 Canadian catch figures not available.

QUESNEL REHABILITATION

During August 1947, 678,000 artificially fertilized sockeye eggs were taken in the Upper Bowron River, eyed out at a temporary "eyeing" station and flown by the Washington State Fisheries patrol plane to Bellingham, Washington. 48,000 eyed eggs were shipped from there to the University of Washington to be used for a special experiment in accelerated growth. The remaining eggs were transferred to the Washington State Samish Hatchery and later transferred to the State's Skagit Hatchery for hatching and rearing.

In May the fingerling sockeye hatched and reared at the University of Washington were transferred in three lots from Seattle to Leavenworth, Washington, with a 1,000 gallon tank truck received on loan from the United States Fish and Wildlife Service. Because of bad road conditions in the Fraser Canyon during the spring, and excessive weight of the tank truck, the fingerling sockeye were routed to Eastern Washington prior to the final move to Horsefly River. After a resting period at the Leavenworth Hatchery, the transfer was accomplished by two types of tank trucks. That part of the trip from Leavenworth to the 150-Mile House, British Columbia, was accomplished with the 1,000 gallon Fish and Wildlife Service truck and from there 37 miles into Horsefly River with two light tanks received on loan from the Washington Department of Fisheries. A total of 39,358 fish were planted in the Horsefly River in this experiment.

The time en route from Seattle to Leavenworth was 5 hours and from Leavenworth to Horsefly River 36 hours (approximately 700 miles) with a 4.31 per cent mortality in the fingerlings during transit and planting.

In August 162,549 fingerlings were transported directly to the Horsefly River from the Skagit Hatchery with the 1,000 gallon Fish and Wildlife Service tank truck and planted. During transportation and planting of this second lot of sockeye fingerlings the total mortality was 0.57 per cent. These fingerlings, being of the 1947 brood year, should return to the Horsefly River in 1951 as adult sockeye four years old.

GILL NET MESH INVESTIGATION

The gill-net mesh experiment initiated in 1947 was repeated this year on a run of sockeye composed mainly of early-season Chilko fish. Again two gill-net boats fished for the Commission in the Steveston area of the Fraser River with ten different mesh sizes ranging from 5¼ inch mesh to 8¾ inch mesh. The net used by each boat was made up of five 40 fathom sections of different mesh sizes attached together. The two boats fished on the same grounds simultaneously, one boat using five of the ten mesh sizes, the second boat fishing with the other five. Commission observers who were aboard the boats during all fishing operations gathered pertinent data regarding the size, sex and age of all salmon caught by the varied sized meshes.

The results showed that each mesh had a definite selective action on sockeye salmon, the smaller meshes taking mainly the smaller fish with females predominating, the larger meshes up to 7½ inch mesh catching mostly the larger sockeye with males in the majority. The 7½ inch mesh as in the 1947 experiment caught significant numbers of sockeye while the 8 inch mesh or larger took few sockeye. The evidence from both the 1947 and 1948 experiments demonstrated clearly the validity of the 8 inch minimum mesh size as prescribed by the Commission during the seasons closed to sockeye fishing. The results from these experiments for the two years are now being given a careful detailed analysis.

FIG. 2.—A falls in the Nechako Canyon representative of the natural obstructions which have prevented the lakes in the Tweedsmuir Park area from becoming sockeye producers.

PRELIMINARY SURVEYS

During the summer of 1948 the biologist in charge of the Stuart-Nechako district made several trips to areas not previously explored as far as conditions for sockeye migration and spawning are concerned.

Many large lakes and streams in the Tweedsmuir Park area were surveyed to determine the possibilities of rearing sockeye in this area. At present they are inaccessible to salmon because of a series of falls and rapids which they cannot negotiate (Figure 2). The possibility of circumventing these by means of fishways is being studied by the Commission's Engineering staff.

The survey was made by boat starting at Ootsa Lake. The following lakes were visited: Ootsa, Intata, Natalkuz, Euchu, Chelaslie, Whitesail, Eutsuk, Pondosy, and Tetachuck. The streams connecting these lakes and the larger tributary streams were evaluated as to the available spawning area, while the lakes were checked as to their ability to meet the requirements of sockeye fry and fingerlings during the time they would spend in the lake. It was not possible during the preliminary surveys to establish definitely any of the environmental limitations to the introduction of sockeye runs to this area.

A canoe trip was also taken on the Nechako River from Fort Fraser to Prince George. The present Stuart Lake and Stellako River sockeye runs use this river to reach their respective spawning grounds. Construction of a proposed dam on the Upper Nechako River would remove a large part of the flow from this stream and information was desired as to what effect this would have on the section of this river now used by sockeye salmon. Several canyons and rapids were found that will require additional study if the flow of this river is artificially reduced.

HELL'S GATE INVESTIGATIONS

Tagging operations at Hell's Gate were continued in 1948. These were carried out to check the efficiency of the fishways and also to establish additional information as to passage of sockeye at this difficult reach of the river at levels above which the fishways operated. Tagging operations began this year on July 3 and terminated October 9. During this period a total of 6,040 sockeye were tagged. The water levels this year during the period of sockeye migration were unusually high. The number of days of levels at which sockeye were blocked previous to installation of the fishways was 105 as compared to the 115 days which caused the serious blockade of 1941. No evidence of delay was found during levels at which the fishways operate. Between August 28 and 31, however, the water rose to the 61 foot level. There was some indication that sockeye had difficulty passing the Gate at this time, but because the period of high water level was short, the delay was not serious.

Engineering Operations

All construction projects and the maintenance and operation of all fishways were considerably handicapped by the severe climatic conditions and river run-off characteristics. Following a delayed spring with a heavy snow fall, the Fraser River, along with other major streams of the region, rose to a flood stage almost equal to that of the record flood of 1894. The effects of the flood on the general economy of the region have been widely publicized.

The tributaries of the Fraser River watershed remained high throughout the year. Severe fall and winter conditions set in, characterized by early freezing of the ground and continuous snowfall. These conditions have made repair work brought about by the flood extremely difficult to accomplish. The floods increased all maintenance items and required the replacement of access roadways and bridges. The high flood stage scoured the banks at levels which have been untouched by water for many years, thus bringing down an unusually large amount of heavy debris on the decks of the fishways and depositing large amounts of bed load material in and about the structures.

HELL'S GATE FISHWAYS

The temporary construction camps built on the left bank of the river have been abandoned. Quarters for a small maintenance crew have been constructed on the right bank opposite the fishways. In order to gain direct access to the right bank fishway deck, a concrete ramp-type bridge, 64 feet in length, has been constructed to connect the fishways to a road-way leading to railway track level. This improvement will reduce the cost of the maintenance and operation of this structure by permitting the movement of both large and small equipment directly on to the operating deck.

The fishways were overtopped on the 15th of May and were submerged under 55 feet of water at the flood crest on May 31. The river returned to the maximum operating level on July 5. During this time of submergence, the following occurred at the fishway site. The access bridge across the river was swept away. The access roads were scoured out to the point of maximum flood. On the left bank from above the rip-rap placed during construction, the bank slid from railroad level on to the deck of this fishway. There remains to be worked out with the railroad a method of protecting their bank upwards from the fishway level. Owing to the adverse winter conditions little has been accomplished on this protective work. On the right bank the concrete mixing plant erected 30 feet above the deck of the fishway was swept away. This plant has been replaced by one 65 feet above the deck of the fishway. A portion of the rock bank at the downstream end of the right bank tunnel was carried away by the flood. A number of gratings were lost on the left bank fishway and a number of others damaged by the slide materials from the banks. These gratings will be replaced. An unusually large amount of rock found its way into the fishway owing to the loss of these protective gratings and because of the large amount

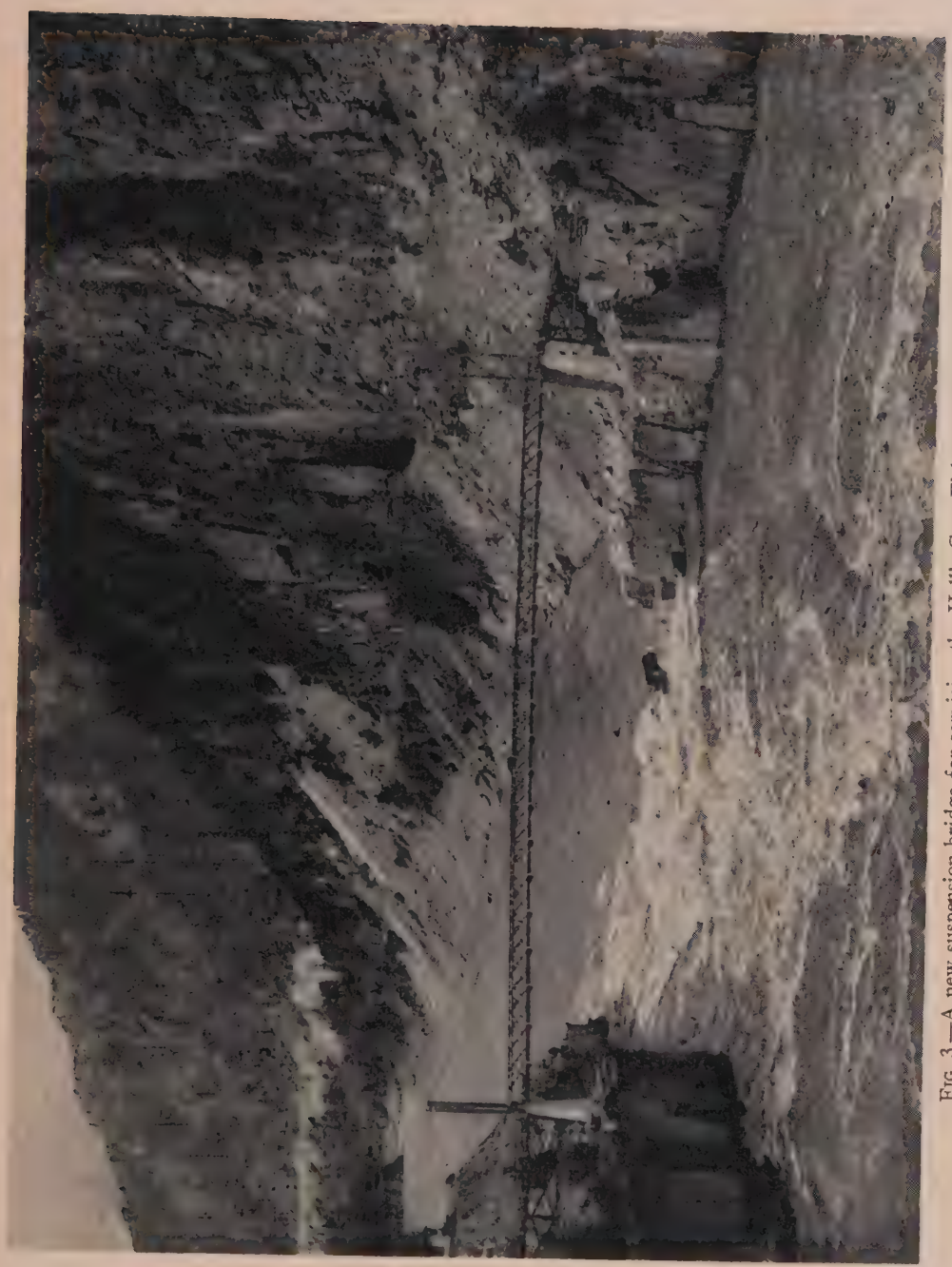

FIG. 3.—A new suspension bridge for servicing the Hell's Gate Fishways, built at elevation 126 to replace the old foot bridge carried away by the 1948 flood. The new elevation is 10 feet higher than any known flood level. Picture taken during the 1949 river flood stage.

of bed load material carried by the river. The fishways operated throughout the migratory times of the sockeye, which from the fisheries standpoint was more essential than ever before as the river levels remained at the past block levels throughout most of this period.

At the close of the year new concrete anchors and bridge piers were well under way for the replacement of the access bridge lost in May.

BRIDGE RIVER RAPIDS FISHWAYS

The Bridge River fishways were submerged by 30 feet of water at the crest of the flood flow. There was no structural damage to the fishways. The flow however washed away the approach road at the turn-out point and the access road to the lower fishway. After the subsidence of the flood crest, the portion of the entrance road lost was rebuilt. It was found that in the lower fishway approximately eight feet in depth of bank material or bed load was carried into the structure. The river levels, however, stayed well up so that the fishways operated throughout the entire period of the migration of adult sockeye. Freezing weather began before the fishways were dry and the cleanup work must be necessarily delayed until spring. A 50-foot portion of the road leading between the upper and lower fishway must be revetted as the high water so eroded the bank as to undermine this part of the road. A part of this material found its way into the lower fishway.

FARWELL CANYON FISHWAYS

The Chilcotin River, at a record flow, submerged the fishways this year eight feet in depth. Under average high water conditions these fishways would not be submerged. No structural damage occurred to the structures but again the bed load material washing in from the banks deposited an unexpected quantity of materials in the fishway structures. They remained operative, however, throughout the entire Chilko run. The road leading to the project was damaged by having a section washed away by the high water stage. This was repaired. Above Farwell Canyon where the river widens, the entire river channel shifted from the right side of the valley to the left side, in this manner altering the river's approach to Farwell Canyon. Until the river returns to its original course the upstream left bank fishway will not be required as this major alteration in the river channel has temporarily eliminated the drop at the entrance to Farwell Canyon. The fishway is still operative and remains effective when the river returns to its original channel. The late high water, plus the freezing conditions, have delayed the cleanup and repair work at this point until spring and more favourable weather conditions. While the wash of the river did not cause any immediate bank slides, there has been sufficient erosion along certain sections of the bank toes that slides may be expected within a reasonable time to cause further troubles in Farwell Canyon. The Commission will continue its patrol of this area in order that such slides, if they develop, will not affect the flow pattern in the canyon reach.

SCALE MODELS

Requests were received for scale models for exhibit purposes by the Governments of Canada and the United States to show the improvement work at Hell's Gate Canyon. Two models at a scale of 1″ to 20′ were constructed.

QUESNEL FIELD STATION

Construction work towards the completion of the field station to its designed capacity has been continued. The work has been necessarily slowed to what could be accomplished under cover during the winter. The completion of ponds and water supply systems could not be undertaken during sub-zero conditions.

BIRKENHEAD RIVER

The Birkenhead River, like most streams, had a record or near-record flood. The newly-placed gauge on this river was carried away and there have not yet been any estimates given as to the peak flow of this stream. The conditions reported on last year have been completely altered by this flood; the Birkenhead has left its old channel in the delta area practically dry. It was in this old channel that the greatest percentage of the spawn of the sockeye salmon was deposited. The flow in this channel was critical, as the adult salmon could enter and spawn with the spawn subsequently going dry as the flow decreased during the low flow winter months. It was decided to do temporary protective work at this point. A low gravel dyke was placed across the old channel which sufficiently diverted the water to prevent the entrance of adult sockeye in this channel. A subsequent rise in the river removed this dyke but only after the majority of the fish had entered the river. It is believed that this work prevented a possible major loss of the Birkenhead spawning sockeye.

CONSTRUCTION OF POWER PROJECTS IN THE FRASER RIVER

Through press reports the Commission has learned that consideration is being given to the possibility of developing water power at a number of sites in the Fraser River watershed. One such proposed power site at Chilko Lake calling for the waters of the Chilko and Taseko Lakes to be diverted to the Coast will be reported on in detail by a special report covering the possible effect on the sockeye salmon. The unusual flood of 1948 and its subsequent damage in the lower valley has also stimulated discussions on flood control by means of lake storage. All of these measures will, to some extent, affect the production of sockeye in the Fraser system. While the Commission has been giving attention to such general problems, these new developments have required the Commission to speed its examinations of such proposed sites in order that the effects of such projects on sockeye fisheries could be evaluated. This, of course, has required a re-assignment in priority of work in order to undertake this accelerated investigation.

FIELD SURVEY WORK

In order to approach the problems of multiple water use the Commission has been required to make a number of field reconnaissance surveys immediately. Aerial photography has been used and pictures taken of a number of major spawning grounds or places of proposed river developments. Ground control work has gone on at the Adams and Little River spawning grounds, and on the Chilko spawning grounds. Ground survey work will continue until all major spawning grounds are properly referenced. Such survey work can be conducted most economically only during the summer and early fall.

SURVEYS FOR OPENING UP NEW SPAWNING AND REARING GROUNDS

A number of potential lake areas are now inaccessible to spawning sockeye salmon owing to natural river obstructions, one such river being the Upper Nechako, which is blocked by the Nechako Canyon. By a combination of aerial pictures and ground control this entire canyon has been surveyed and contoured. The purpose of this survey was to determine the feasibility of opening up the Nechako Canyon for the passage of sockeye salmon. Only the mapping has been completed at the end of this year. Such work indicates that it is possible to eliminate the blocks existing in the Nechako Canyon. Such types of survey will continue on the streams leading to major, but now inaccessible lakes in the watershed.

EXPERIMENTAL WORK AT THE UNIVERSITY OF BRITISH COLUMBIA

Experimental Work at the University of British Columbia:

The program of hydraulic experimentation for the improvement of fishway designs has continued at the University. The results of these findings, when completed, will be published as a special report.